

*The Brattle Group*

# Dynamic Pricing: Past, Present, and Future

*Presented to:*

**Canadian Association of Members of Public Utility Tribunals  
Queen's University, Kingston, Ontario**

*Presented by:*

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# Agenda

- 1. Background in dynamic pricing**
2. What have we learned from dynamic pricing pilots?
3. Accommodating objections to dynamic pricing
4. Potential of dynamic pricing
5. References

# Dynamic pricing (DP) comes in a wide variety of forms

## Summary of Time-based Pricing Products

Rate	Description
<b>Time-of-Use (TOU)</b>	Charges a higher price during all weekday peak hours and a discounted price during off-peak and weekend hours
<b>Super Peak TOU</b>	Similar to the TOU with the exception that the peak window is shorter in duration (often four hours), leading to a stronger price signal
<b>Critical Peak Pricing (CPP)</b>	Customers are charged a higher price during the peak period on a limited number of event days (often 15 or less); the rate is discounted during the remaining hours
<b>CPP-TOU Combination</b>	A TOU rate in which a moderate peak price applies during most peak hours of the year, but a higher peak price applies on limited event days
<b>Peak Time Rebate (PTR)</b>	The existing flat rate combined with a rebate for each unit of reduced demand below a pre-determined baseline estimate during peak times of event days
<b>Flat Real Time Pricing (RTP)</b>	A rate with hourly variation that follows LMPs, but with capacity costs allocated equally across all hours of the year
<b>Critical Peak RTP</b>	A rate with hourly variation based on LMPs and with a capacity cost adder focused only during event hours, creating a strong price signal at these times

**Note:** TOU rates are not considered dynamic, yet included in this slide to give a complete picture of time-based pricing products

## What is the current state of DP deployment?

**TOU is the most commonly implemented time-based rate option for all customer classes and is largely deployed as a full-scale offering**

**CPP is more commonly tested through pricing pilots at this stage- although there are full-scale implementations**

**RTP is most typically deployed as a full-scale offering for C&I customers**

**PTR has only been tested through pilots as of yet – but this is likely to change**

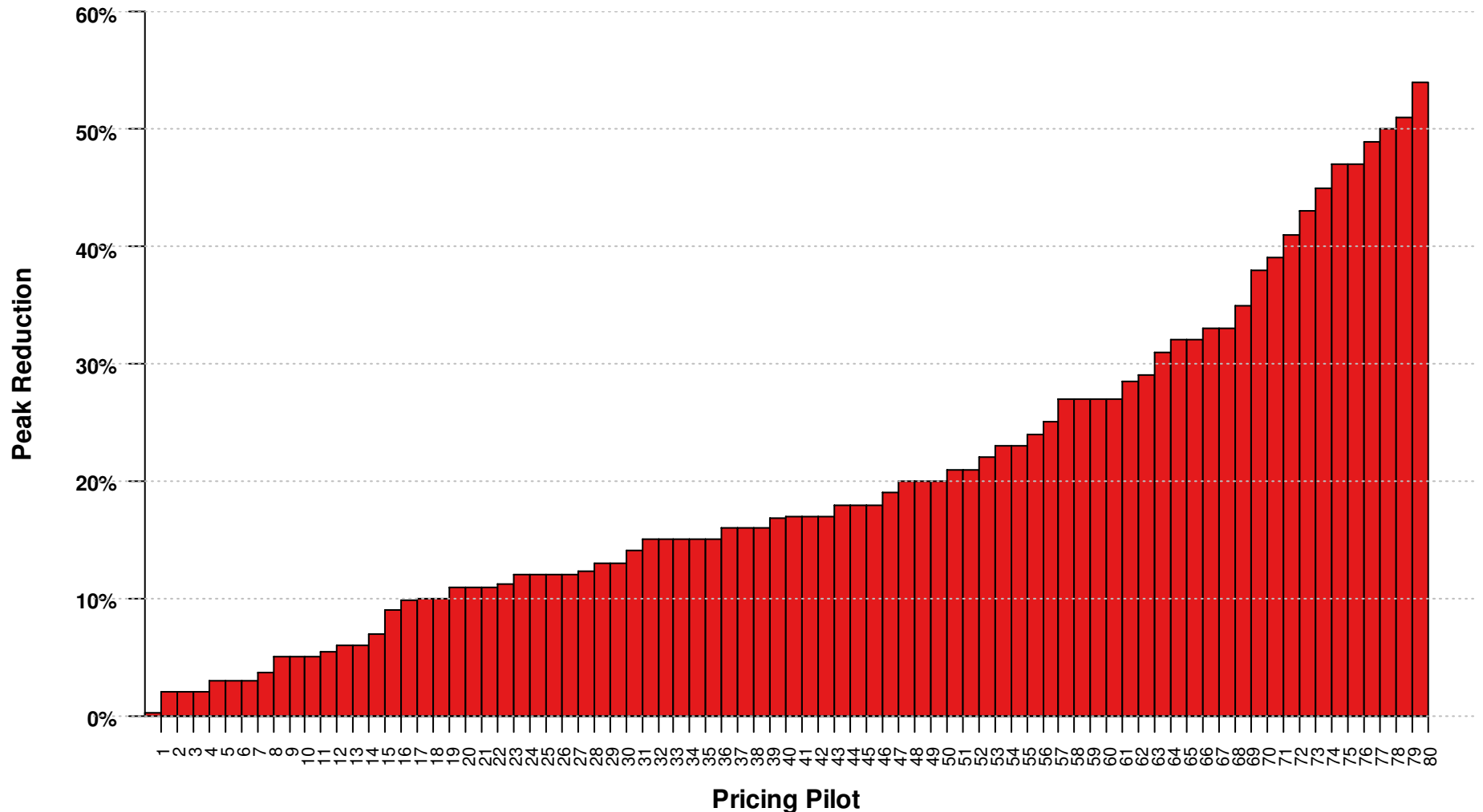
**C&I customers are offered time-based rates much more frequently than the residential class and are more likely to be exposed to dynamic rates like RTP and CPP**

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# 1. Customers do respond to DP

## Impacts from Residential Pricing Pilots



# Why the variation in impacts?

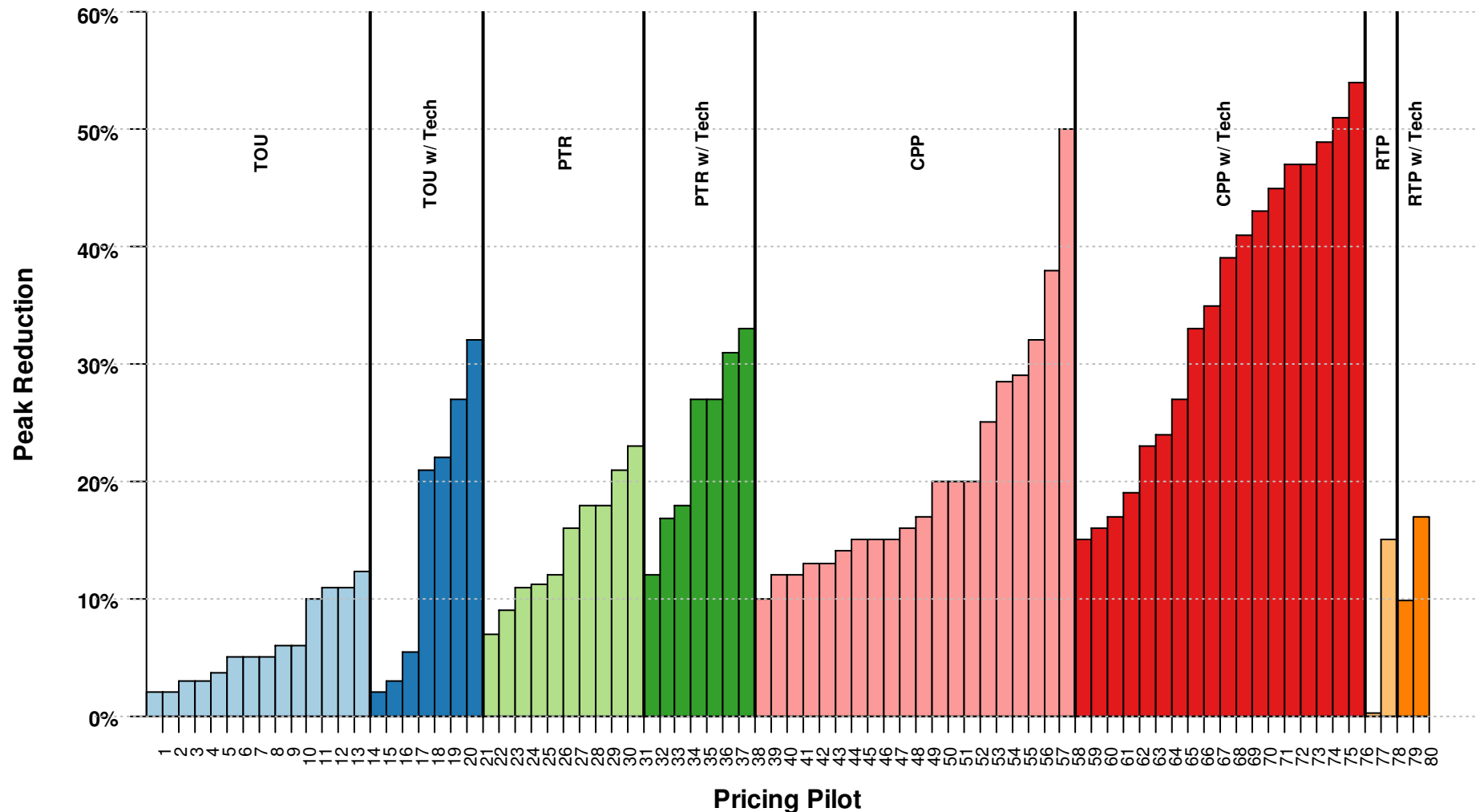
**Rate, technology, and pilot design are only part of the puzzle**

## **Other factors include**

- ◆ Price signal
- ◆ Central-air conditioning (CAC) saturation
- ◆ Other appliance saturation
- ◆ Type of enabling technology
- ◆ Weather
- ◆ Sociodemographic factors
- ◆ Marketing/incentives/education

## 2. Enabling technologies boosts the impacts

### Peak Reductions by Rate and Technology





### **3. Customer response is not a novelty and persists over time**

**Several recent DP pilots have specifically tested the persistence of customer response when events are called across two or three days in a row and found persistence**

**At least two pilots that have run for multiple years have tested persistence across years and found persistence**

**Two utilities in Arizona have observed persistence in customer response to time-of-use rates across decades**

## **4. Pilots are good indicators of the impacts in full-scale deployments when they are carefully designed**

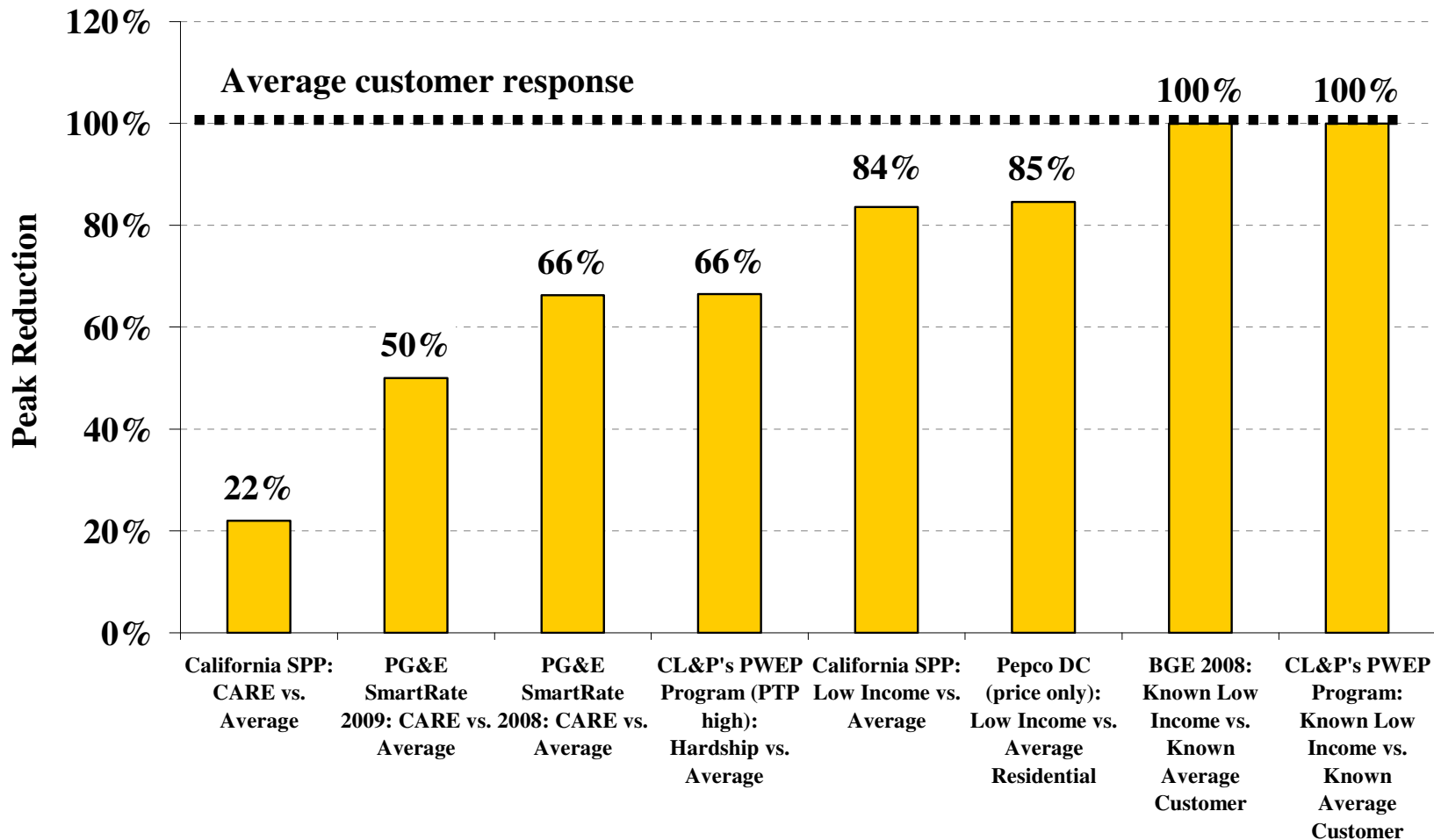
**In the best pilots, treatments and control customers are randomly selected to be representative of the population at large**

**Pre-treatment measurements were taken to net out any pre-existing differences between the treatment and control groups**

**Pilot design and roll-out approach must mimic utility's full deployment approach as much as possible**

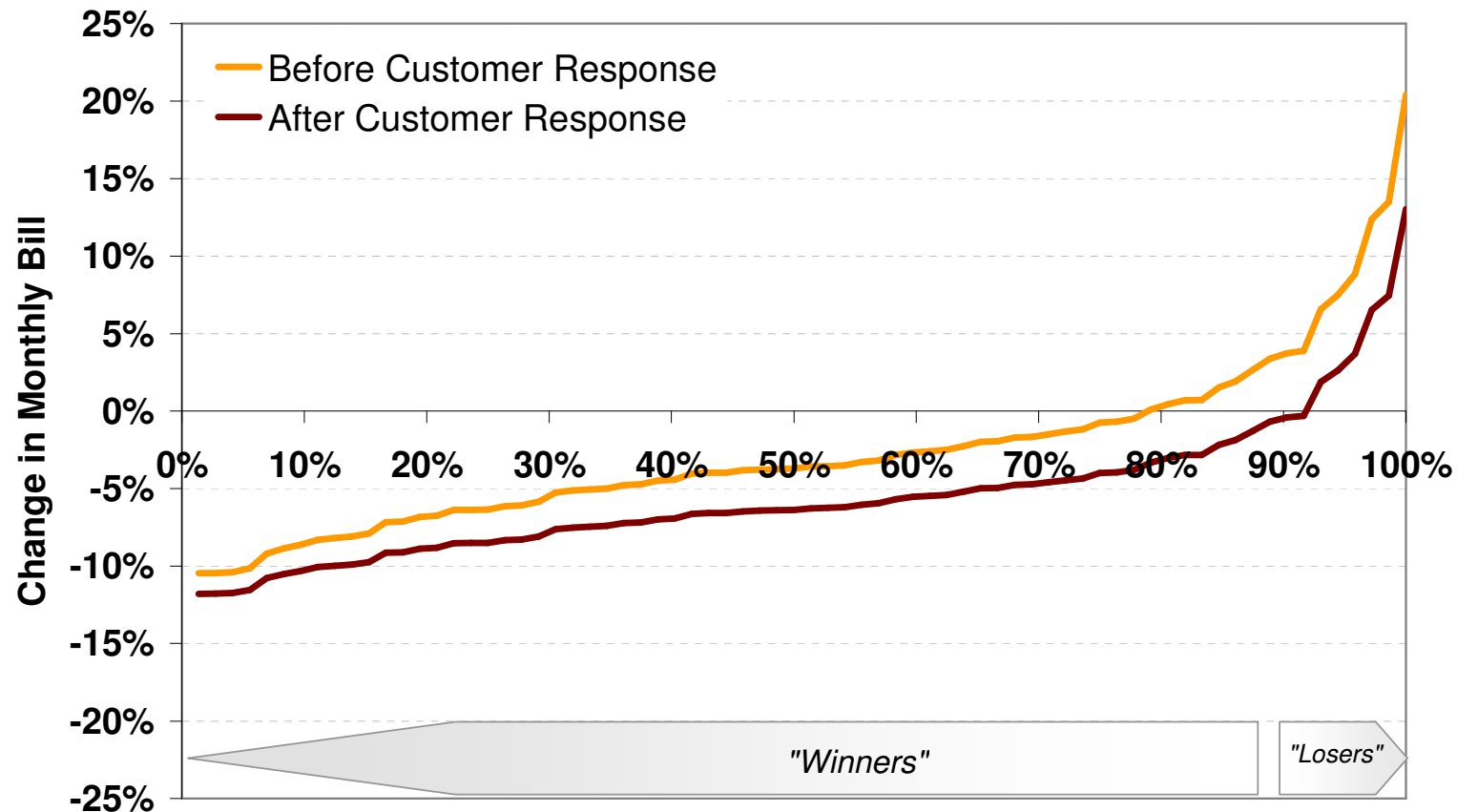
# 5. Low income customers do respond to DP

**Low Income Customer Responsiveness  
Relative to Average Customer Response**



## 6. Most low income customers will be better off under DP due to their flat load profiles

**Distribution of Dynamic Pricing Bill Impacts  
- Low Income Customers on CPP Rate -**



**Notes:** Bill Simulation results for a large urban utility.

Assumes an average of 10% load response for low income customers

## 7. Customers are satisfied with DP once they experience it

### Customers are already familiar with the idea of dynamic pricing

- ◆ Cell phone minutes
- ◆ Airline tickets and hotel rooms
- ◆ Toll roads and bridges
- ◆ Sporting events and shows

### In the case of electricity, they tend to associate it with high prices and price volatility

- ◆ When they are asked if they want it, in focus group settings or telephone interviews, the majority say no
- ◆ When they have lived through it, either in full-scale programs or in pilot settings, the vast majority report high satisfaction and want to continue with the rates

## **8. Direct load control programs are not substitutes but complements to DP programs**

**Direct load control (DLC) only applies to customers who have air conditioning or water heating; other end-uses in the home are not incentivized to respond during critical events**

**Payments are made whether or not events are called and without smart meters, it is hard to verify that the controlled load has actually responded**

**Traditionally, direct load control is only triggered by reliability events**

**In general, DP can yield higher load responsiveness when combined with enabling technology than DLC and it can be triggered by either economic or reliability events**

## 9. We also know more about potential pilot implementation “landmines”

- ◆ Test rates with significant price differentials
- ◆ Set or program enabling technologies during installation
- ◆ *Carefully* recruit via multiple channels
- ◆ Manage customer expectations
- ◆ Be prepared to explain bill increases
- ◆ Provide feedback about savings quickly and frequently
- ◆ Communicate with external *and* internal stakeholders
- ◆ Document reasons for unenrollment
- ◆ Beware of unrepresentative meter footprint
- ◆ Track “walk-ins”

**More detail in a forthcoming Brattle paper...**

## 10. After all the experimenting, there are still things we know poorly

### **Conservation impact of dynamic pricing needs more research**

- ◆ Several recent pilots suggest 0% to 1% savings
- ◆ Other studies have suggested 2% to 4%

### **Customers respond equally to peak time rebates and critical peak pricing in some tests and unequally in other tests**

### **Customers respond to informational feedback about energy usage, prices and utility bills**

- ◆ By how much they respond remains uncertain
- ◆ The impact on peak demand is uncertain
- ◆ Whether either energy or peak demand response would persist over time is also uncertain

### **The specific impact of web portals, in-home displays and energy orbs needs more research**

### **Impact of socio-demographic variables (e.g., income, education) on customers' price responsiveness also need more research**



## Several new concepts will be tested in the DOE-funded consumer behavior studies

- ◆ Variable peak pricing
- ◆ PTR as a transition tool
- ◆ Technology acceptance
- ◆ Pre-payment billing
- ◆ Sample selection methods
- ◆ Pricing period duration
- ◆ Bill protection
- ◆ Information access patterns
- ◆ Enhanced education
- ◆ Test-and-learn

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# Accommodating objections to dynamic pricing

## Creating customer buy-in

- ◆ Changing a century-old ratemaking practice will require significant customer education and management of expectations

## Offering tools

- ◆ Improved billing information
- ◆ In-home information displays
- ◆ Enabling/automating technologies

## Two-part rate design

- ◆ Allows customers to manage the amount of usage exposed to the dynamic rate

## Peak-time rebates

- ◆ Creates a “no lose” situation for all customers, while still providing the incentive to reduce peak usage

# Accommodating the objections (cont'd)

## Bill protection

- ◆ A “no losers” proposition for the first few years
- ◆ Phase out over time as part of educational initiative

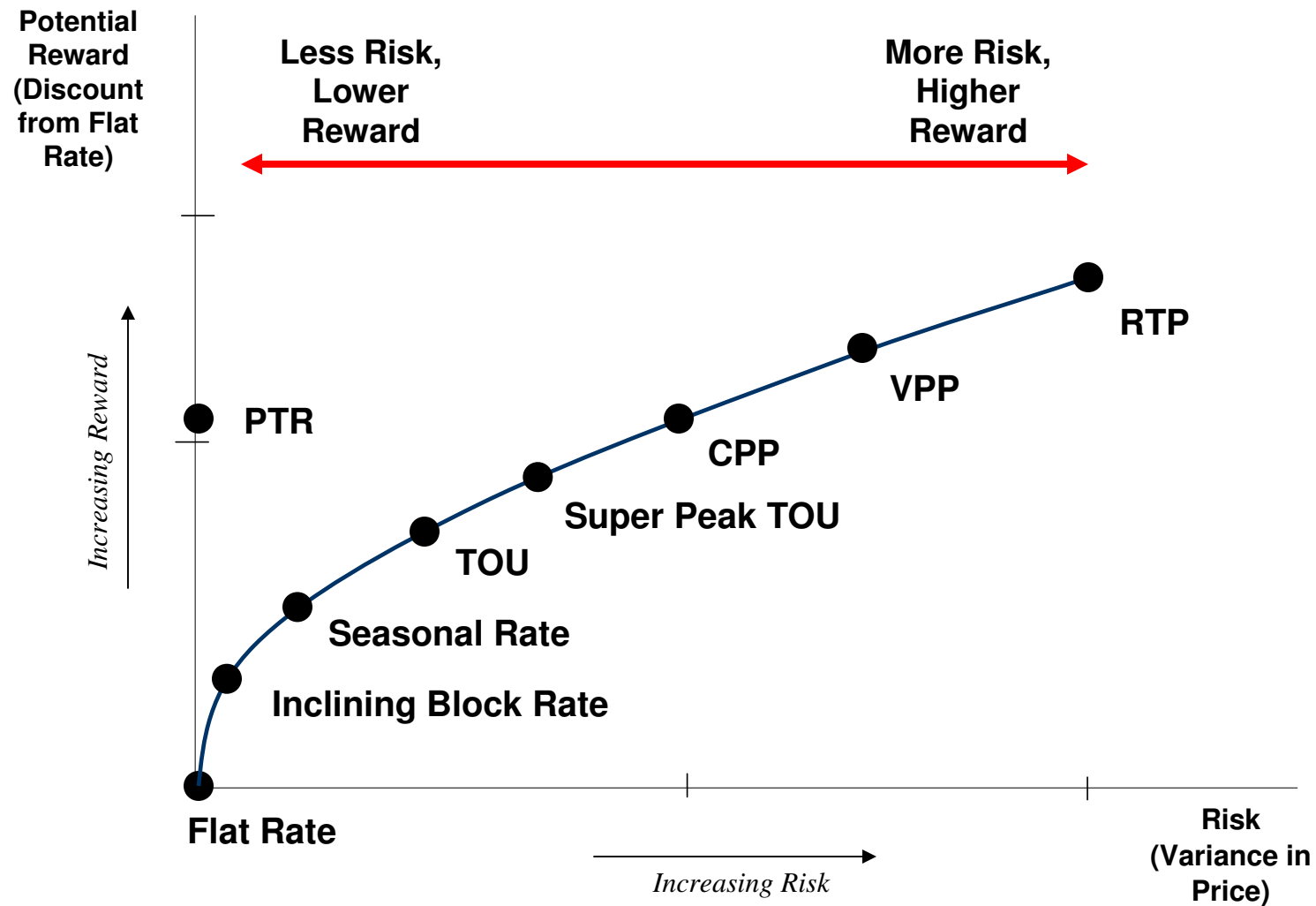
## Crediting customers for the hedging premium

- ◆ Flat rates sometimes include a premium to account for the price and volume risk associated with wholesale power purchases
- ◆ If price fluctuations are passed through to the retail rate, this risk is transferred to the customer and the premium is eliminated or reduced

## Creating a menu of tariffs anchored around dynamic pricing

- ◆ Give customers the option of migrating to other time-varying rates or even hedged flat rates

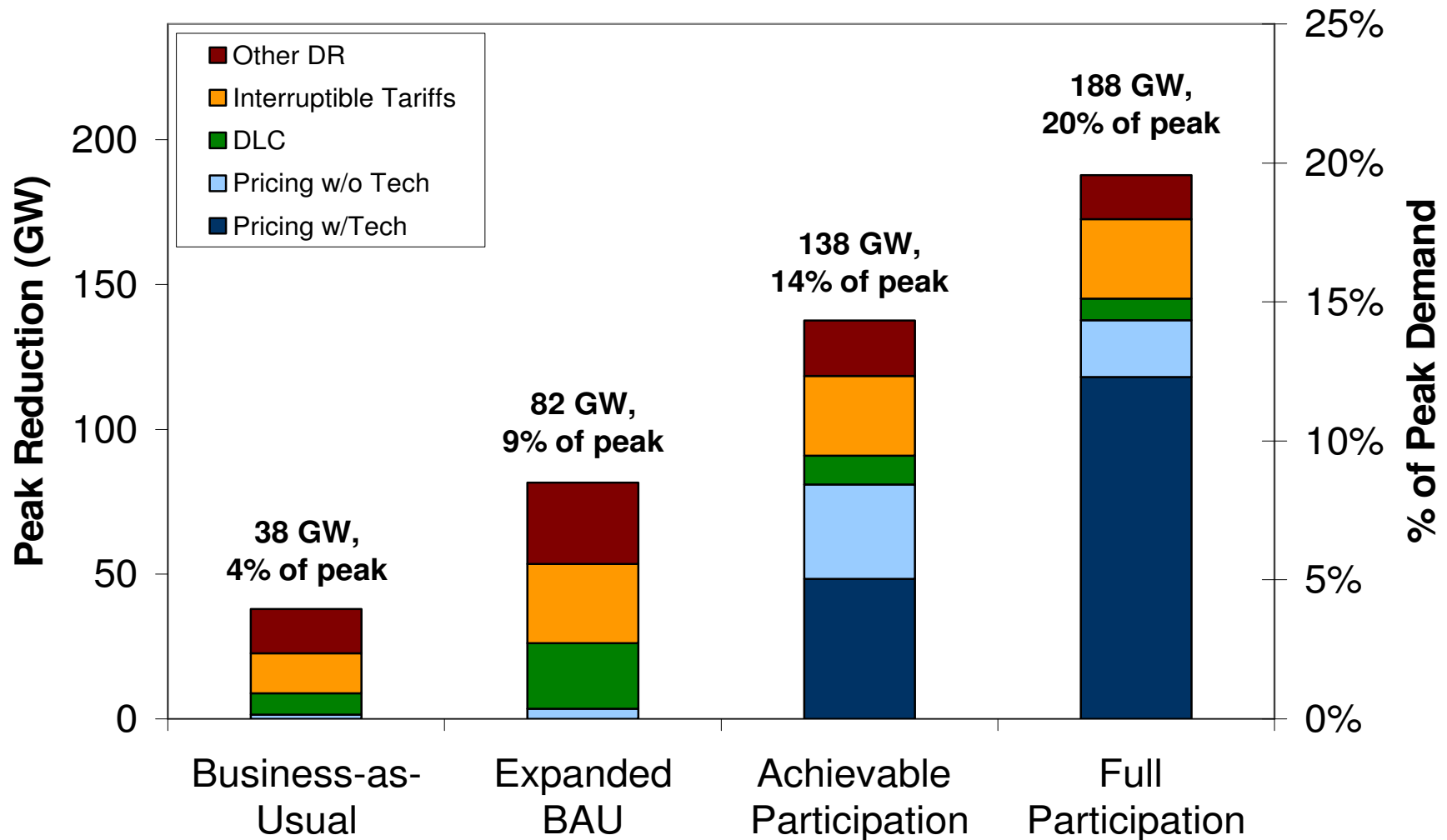
# Current risk-reward frontier for electric rates



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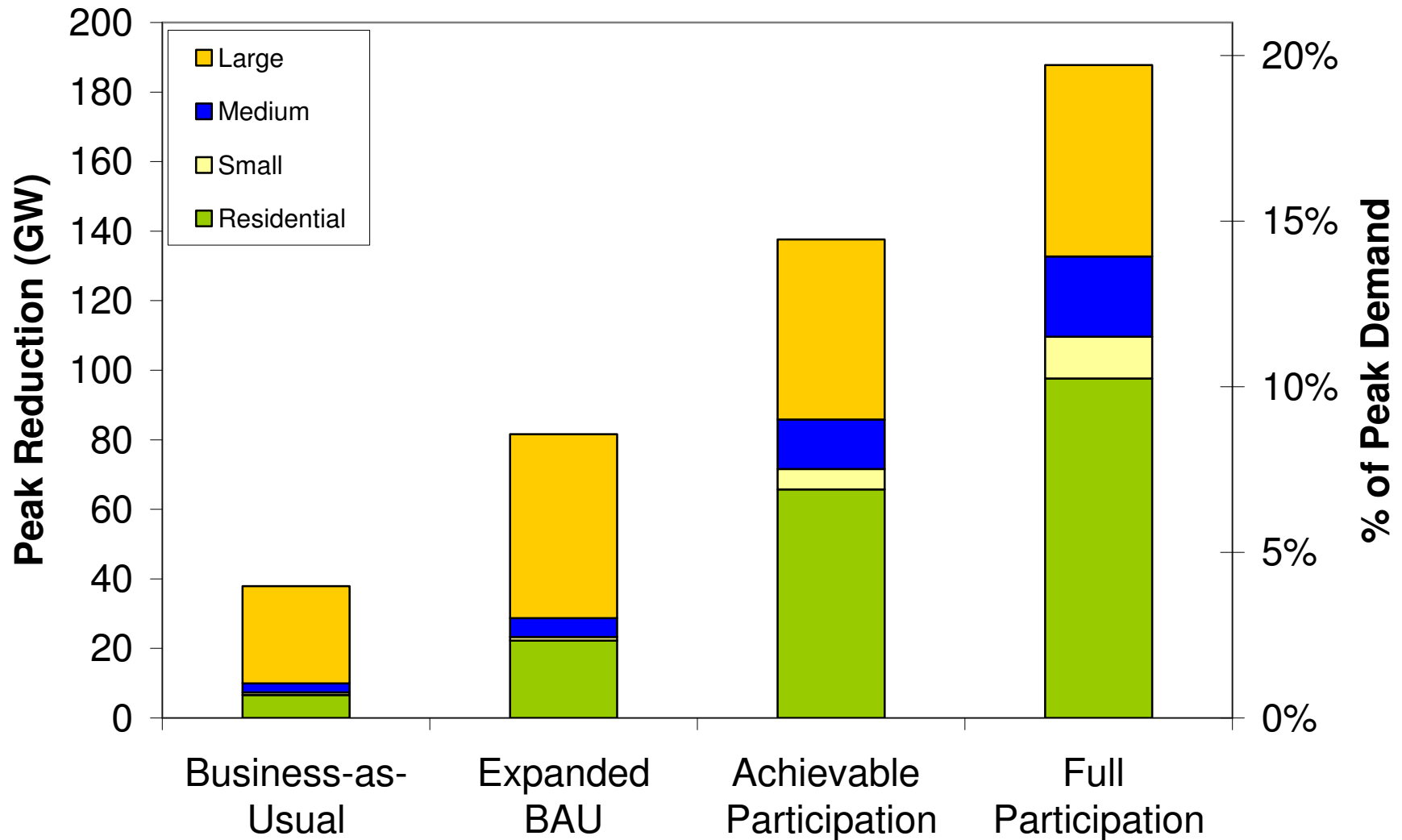
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# Aggressive pursuit of dynamic pricing can lead to substantial reductions in peak demand



Source: FERC DR Potential Study (2009)

# Much of the untapped potential for dynamic pricing resides in the residential class



Source: FERC DR Potential Study (2009)



## Dynamic pricing would improve the economics of new smart grid technologies

<b>Smart Grid Element</b>	<b>Effect of Dynamic Pricing</b>
<b>Rooftop solar applications</b>	<b>Rewards self-generation during peak (sunny) hours</b>
<b>Distributed storage</b>	<b>Provides price differential to encourage load shifting</b>
<b>Plug-in electric vehicles</b>	<b>Encourages more efficient charging patterns</b>
<b>In-home information displays</b>	<b>Improves intrinsic value of the device to the owner</b>
<b>Grid-friendly appliances</b>	<b>Provides price signal to encourage peak savings</b>

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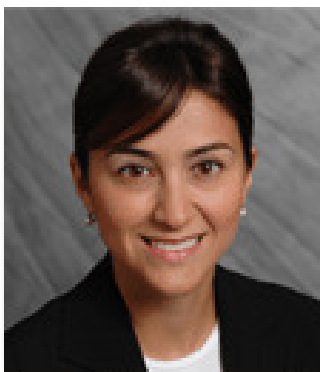
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Sanem Sergici is a Senior Associate of *The Brattle Group* with expertise electricity markets, industrial organization and applied econometrics. At *Brattle*, the focus of Dr. Sergici's work has been on assisting electric utilities, regulators, research organizations and wholesale market operators in the development of innovative demand response and energy efficiency portfolios and strategies. Dr. Sergici has expertise in the design and evaluation of dynamic pricing pilot programs, development of load forecasting models, and design of innovative rates for electric utilities. Her recent engagements include assisting the utilities in Michigan, Connecticut, Illinois and Maryland in the design and impact evaluation of their pricing and technology pilots. Dr. Sergici is a member of a Technical Advisory Group (TAG) for Smart Grid Investment Grant projects that was formed by the U.S. Department of Energy (DOE) and Lawrence Berkeley National Laboratory (LBNL). She has spoken at several industry conferences and published in several industry journals.

Dr. Sergici received her Ph.D. in Applied Economics from Northeastern University in the fields of applied econometrics and industrial organization. She also holds an M.A. in Economics from Northeastern University, and B.S. in Economics from Middle East Technical University (METU), Ankara, Turkey.

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